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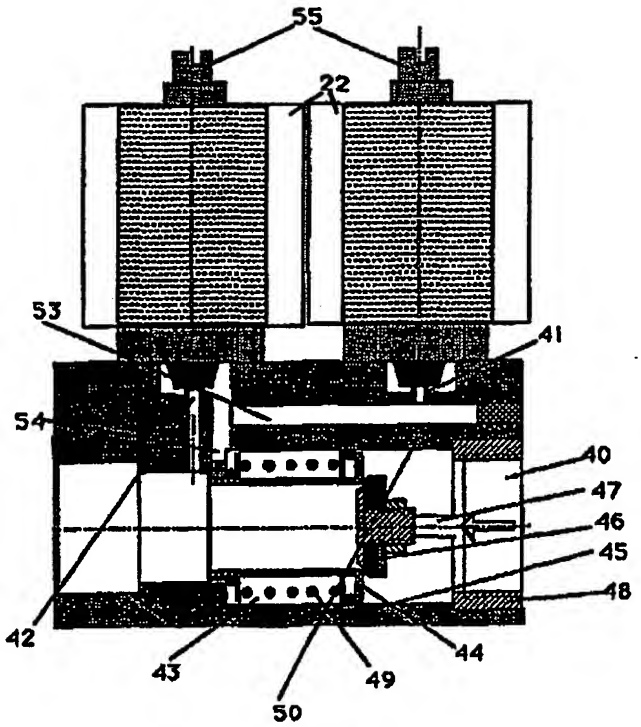
(54) Title: IN-LINE VALVE CONTROLLED BY PILOT OPERATED PRESSURE CHAMBER BEHIND THE VALVE MEMBER

(57) Abstract

Preferred forms provide control over inlets (41) and/or outlets (42) from the pressure chamber (43) to use the fluid pressure on the high and low sides of the valve mechanism to create the variations in pressure in the pressure chamber (43). Further examples include embodiments in which the control is provided on both the inlet and the outlet to allow the valve to open to stable positions intermediate of the fully opened and fully closed positions. Further, an embodiment (Figure 13) including a pressure reduction valve (64) and a further embodiment (Figure 11) in which the fully opened position is adjustable by including a screw adjustable orifice on inlet (41). The preferred embodiment includes an axial relationship between the control surface and the inlets and outlets.



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IN-LINE VALVE CONTROLLED BY PILOT OPERATED PRESSURE CHAMBER BEHIND THE VALVE MEMBER

A FIELD OF THE INVENTION

This invention relates to fluid control mechanisms and methods of controlling fluids and, in particular, although not necessarily solely valve mechanisms. The fluid may comprise liquids such as water, hydraulic fluids or also pneumatic fluids.

BACKGROUND TO THE INVENTION

Conventional devices such as valves include globe, gate, ball, butterfly and check valves, all of which are used for flow control in a conduit.

Valves such as gate, ball and butterfly valves rely on squeezing off the flow in the conduit during the closure operation. This can lead to flow turbulence and other uneven flow characteristics.

Globe and check valves use internal valve seats and valve plugs. Although these valves provide better flow characteristics, these valves need to divert the flow leading to large changes in flow direction. Furthermore, such valves are more expensive to manufacture.

Also, many conventional valves require a substantial increase in pipe diameter about the valve to accommodate the valve mechanism. This is

often due to the need to divert the flow about a control surface that is not in line with the axis of the inlet and outlet ports of the valve.

Many conventional valves require an increase in the mechanical pressure to close the valve with an increase in differential pressure across the valve.

Furthermore, valves involving large changes of flow direction or the squeezing off of the flow during the closure sequence can lead to increased noise in operation.

OBJECT OF THE INVENTION

It is an object of the present invention to overcome or reduce some of the disadvantages of the prior art or at least provide the public with a useful choice.

SUMMARY OF THE INVENTION

In a first aspect, the invention consists in a fluid control mechanism comprising:-

a conduit to carry a fluid having an axis therethrough;

a fluid control surface within said fluid flow and having a high pressure side and a low pressure side;

a pressure chamber associated with one side of said fluid control surface;
a control means to control the pressure in said pressure chamber and thereby shift the control surface from a first position to a second position; and
wherein said fluid control surface is positioned within said conduit and acts along said axis of said conduit when shifting from said first to said second position.

Accordingly, in the second aspect, the invention consists in a valve mechanism comprising a conduit, a valve seat, a valve plug, a support for said valve plug, a pressure chamber provided on the low pressure side of said valve plug, a first orifice between an inlet side of said valve plug and said pressure chamber, a second orifice between said pressure chamber and an outlet side of said valve plug, control means provided on said second orifice to open or close said orifice, and biasing means to bias said valve plug to a closed position when the pressure in said pressure chamber is at least greater than the outlet pressure and at least less than or equal to the inlet pressure and wherein said valve plug moves axially within said conduit between said open and closed positions.

In a further aspect, the invention consists in a method of controlling fluid comprising:-

providing a fluid control surface within a fluid flow within a conduit to define a high pressure side on one side of said control surface and a low pressure side on the opposed side of said control surface;

providing a pressure chamber associated with said low pressure side of said control surface and controlling the pressure within said pressure chamber to move the fluid control surface axially within said conduit and thereby control said fluid.

In a yet further aspect, the invention consists in:

a conduit to carry a fluid;

a fluid control surface within said fluid flow and having a high pressure side and a low pressure side;

a pressure chamber associated with one side of said fluid control surface;

a control means to control the pressure in said pressure chamber and thereby shift the control surface from a first position to a second position; and

wherein said control means comprises a means to control the passage of fluid from a high pressure side of said fluid control surface to said pressure chamber and further means to control the passage of fluid from said pressure chamber to said low pressure side of said fluid control surface.

BRIEF DESCRIPTION OF THE DRAWINGS

The invention will now be described with reference to the following drawings in which:

Figure 1: is an elevational cross-section through a fluid control mechanism in accordance with one embodiment of this invention;

Figure 2 is a plan cross-section through the fluid control mechanism of Figure 1;

Figure 3: is an elevational cross-section through an alternative embodiment of the invention;

Figure 4: is an elevational cross-section through a yet further embodiment of the invention;

Figure 5: is an elevational cross-section through a yet further embodiment of this invention;

Figure 6: is a plan cross-section through a fluid control mechanism in accordance with a further embodiment of the invention;

Figure 7: is an elevational cross-section through cross-section C-D on Figure 6;

Figure 8: is an elevational cross-section through cross-section A-B of Figure 6;

Figure 9: is a cross sectional view through a yet further embodiment of the invention;

Figure 10: is an end elevation of the apparatus of Figure 9;

Figure 11: is a cross sectional elevation through a yet further embodiment of the apparatus;

Figure 12: is an end elevation of the apparatus of Figure 11; and

Figure 13: is a cross sectional view through a yet further embodiment of the invention.

DESCRIPTION OF PREFERRED EMBODIMENTS

Referring to the drawings, the invention may comprise a fluid control mechanism 1 which in this particular example comprises a valve mechanism.

The basic principles of the valve mechanism 1 may be applied to valves for any fluid including both incompressible and compressible fluids.

The valve mechanism 1 contains a valve seat 2 and a valve plug 3 such that the valve plug 3 may seat within the valve seat 2 to close the fluid flow through the conduit 4.

The fluid control surface or valve plug 3 is provided with a pressure chamber 5 acting on one side of the valve plug 3.

The provision of the valve plug 3 in the fluid stream creates a higher pressure side to the valve mechanism at inlet 8 and a low pressure side to the valve mechanism at outlet 9.

The pressure chamber 5 is provided with an opening or orifice 7 to the high pressure side 8 as well as an outlet conduit 11 leading to an outlet opening or orifice 12 from the pressure chamber to the outlet side of the valve 9.

Clearly, the open orifice 7 into the pressure chamber 5 allows the inlet pressure, p1, to enter the

pressure chamber 5. Provided the outlet orifice 12 is closed, this pressure p1 will develop within the pressure cylinder 5 and equate the pressure behind the valve plug 3 to that on its inlet side. With both pressures equated either side of this control surface 3, only a slight bias is required to move the control surface 3 against the fluid flow.

In preferred forms of this invention, a biasing means is included such as the compression spring 14.

To open the valve mechanism 1 by shifting the control surface 3 to a second position, the outlet orifice 12 from the pressure chamber 5 is opened. This allows the pressure within the pressure chamber 5 to decrease towards the outlet pressure p2. Once the differential pressure between the inlet pressure p1 and the pressure within the pressure chamber 5 is sufficient to overcome the biasing means 14, the valve plug 3 will move away from the valve seat 2 to open the valve.

To accommodate the positioning of the valve plug 3 in the centre of the fluid flow, valve plug support means 15 are provided, in this preferred form, by way of ribs extending across the cross-section of the conduit 4.

As shown in the plan view 2, the ribs 15 may comprise a single rib extending across the entire cross-section of the conduit 4. Alternatively, the ribs could comprise three ribs, preferably equal spaced about the circumference of the conduit 4. Any particular number of ribs 15 may be used although this should be kept to a minimum to reduce the effect the ribs 15 may have on fluid flow through the valve as a whole.

The ribs 15 also support a valve plug support stem extending through the centre of the valve and terminating in a base plate 17. The valve stem 16 provides a guide for the movement of the valve plug 3 and the base plate 17 provides a non-moving surface for the distil end of the biasing means from that adjacent the fluid control surface.

Also included in this invention are sealing means 19 and 20 comprising in this preferred example an O-ring, backing plate and compression spring combination in accordance with the sealing means described in New Zealand Patent Application No. 248648, the disclosure of which should be considered to be incorporated as if individually set forth.

The opening and closing of the outlet 12 from the pressure chamber 5 is provided by a control means 22

which, in this particular example, comprises a manual button or screw type handle to operate the valve mechanism.

It should be noted that the support ribs 15 and valve stems 16 also provide a convenient member for the provision of the conduit 11 to the control means 22 so that the control means 22 may interrupt the flow between the conduit 11 and the outlet 12.

An alternative arrangement for a fluid control mechanism, again a valve mechanism in this example, is shown in Figure 3. The fluid enters the valve mechanism 1 through inlet 8 and is diverted by a housing member 25 through side wall sections 26. The side wall sections 26 may comprise ribs extending downwards to provide a stop for the control surface 27 with spacings between intermediate ribs 26 to provide the fluid flow into the first chamber 28. This first chamber 28 provides the fluid pressure against the control surface 27.

As can be seen in this example, the control surface 27 is provided by a piston ring/cylinder combination. The control surface 27 acts between a valve seat provided by the housing 25 and the intermediate ribs 26.

In this example, the pressure chamber 5 is provided on the outside of the cylindrical outlet 9 defined by the cylindrical wall 29.

In this particular example, the inlet and outlet openings to and from the pressure chamber 5 as well as the biasing means used to bias the control surface 27 to an open or closed position have been left off for clarity. Clearly, any form of biasing means or arrangement of the inlets or outlets will suffice. This embodiment is merely to show an alternative arrangement with the pressure chamber provided externally of the fluid flow through the outlet.

In operation, the embodiment shown in Figure 3 provides the inlet fluid to chamber 28 and up against the control surface 27. The valve is shown in its closed position and upon a reduction of the pressure in the pressure chamber 5 through the opening of a convenient outlet to the pressure through outlet 9, the control surface 27 being in the form of a ring piston will move away from the fluid flow pressing from chamber 28 and allow the fluid to move between the housing member 25 and the cylindrical walls 29 through to the outlet 9.

A further embodiment is shown in Figure 4. In this instance, the valve is provided in a similar manner to that embodiment of Figure 1. However, in contrast, the valve support stem 16 is provided behind the control

surface or valve plug 3. Similarly, the ribs 15 supporting the valve support stem 16 and also carrying the outlet conduit 11 are provided behind the valve plug 3.

This embodiment in cross-section shows only a single rib 15, however, this particular example is provided with three ribs 15 spaced approximately 120° apart from the valve support stem 16 to the outer conduit 4.

As with the embodiment of Figure 1, the pressure chamber 5 is provided behind the valve plug 3 with a compression spring 14 biasing the valve plug 3 to a closed position and the pressures are equalised between the pressure chamber and the inlet pressure.

Also, a sealing means 19 is provided to seal against the cylindrical valve plug 3 as it moves forward with relation to the valve support stem 16 and seal against the internal side of the side wall 32 of the cylindrical valve plug 3. This sealing means 19 is provided by an O-ring, backing plate and compression spring as with the sealing means in the first embodiment.

It should be noted that the inlet to the pressure chamber 5 in all of these embodiments may be provided

with a filter to ensure no foreign matter blocks the orifice providing the opening 7 and effects the performance of the valve 1.

Turning now to Figure 5, the apparatus as shown in Figure 4 is provided with an automatic control means 35. This may be of any convenient type such as an electromechanical device to control the outlet 12 from the pressure chamber 5 upon receipt of the correct electrical impulse. A manual overdrive 36 may also be provided on the automatic system.

A yet further embodiment of the invention is shown in Figure 6. This embodiment comprises two separate control means 22, one control means on an inlet 31 and a second control means on an outlet 32 from the pressure chamber 5. In this particular example, the inlet and outlet conduits 31 and 32 may have a common central access conduit 33 to the core of the pressure chamber 5. It can be seen that the inlet and outlet conduits can be provided in the provision of sufficient ribs 15 supporting the valve assembly.

In this particular embodiment, each of the control means provides separate control to the inlet and outlet from the pressure chamber 5. Therefore, when both control means 22 maintain a close date over the inlet 31

and the outlet 32, a stable pressure is maintained within the pressure chamber 5. A stable pressure within the pressure chamber 5 against a constant pressure from the compression spring 14 and a constant pressure created against the face of the fluid control surface 3 through the pressure of the incoming flow 8 will create a stable condition such that the valve or control surface 3 will not move from that stable position.

From any stable position in which the valve is accommodated, an opening of the control means in Figure 8 over the inlet to the pressure chamber will allow the pressure p1 to enter through inlet 7 and through conduit 31 into the pressure chamber 5. As the pressure increases within the pressure chamber 5, the compression spring 14 will be assisted by the increased pressure within the pressure chamber against the pressure p1 on the inlet face of the fluid control surface 3 and the valve will move towards a closed position. Should the control means 22 close the opening to conduit 31 to maintain a stable pressure within the pressure chamber 5 which is yet to be sufficient to overcome the inlet pressure of the valve even in conjunction with the biasing means 14, the valve will remain in a stationery position partially towards the closed position from its initial stable state.

In the alternative, the outlet control means 22 over conduit 32 may be opened to allow pressure to escape from the pressure chamber 5 to the outlet 12 as shown in Figure 7. This decrease in pressure within the pressure chamber 5 will move the fluid control surface 3 towards the fully opened position. Again, should the opening of the outlet 32 only be momentary, the pressure within the pressure chamber 5 will not decrease entirely to the pressure at the outlet. Therefore, the biasing means may not be entirely overcome and the valve may be halted before it has reached the fully opened position.

In this manner, the control means 22 over both the inlet and outlet to the pressure chamber 5 allows the fluid control surface 3 to be shifted to any position intermediate of its fully opened and fully closed positions and held there while both conduits are closed. In this particularly preferred embodiment, the control means 22 may comprise electromagnetic control means receiving electromagnetic pulses to momentarily open and close the inlet or outlet to the pressure chamber 5 as necessary. In such a manner, very small movements of the fluid control surface 3 are manageable and can be monitored by a suitable control means to ensure that the valve achieves any particular desired position intermediate of the fully opened and fully closed position and maintains that position thereafter.

So far in the description, the pressure supplied into the pressure chamber 5 has come from the pressure difference between the inlet and outlet of the valve mechanism itself. Of course, alternative apparatus could be provided with an alternative high and/or low pressure source so that the valve mechanism as a whole may be operated by the provision of pressure into the pressure chamber 5 from the external source. For example, a hydraulic feed to each of the control means 22 shown in Figure 6, the hydraulic feed to each control means being of differential pressure would allow the same effect to be provided through the provision of different pressures into the pressure chamber 5. Similarly, noematic pressure may be used.

The provision of an external supply of pressure for the operation of the valve may be useful in emergency situations. As shown in the plan view in Figure 6, two conduits 31 and 32 are used as inlets and outlets to the pressure chamber 5. Of course, a further conduit could be incorporated in either of the currently unused ribs 15 to provide an access to a control means such that the further control means can be operated by external pressure in emergency situations. In some uses of valves it is necessary to close the valve should a zero pressure condition arise such as the total absence of

fluid trickling through the valve. In such zero pressure conditions, the ordinary operation of the valve relying on the inlet and outlet pressures from the valve mechanism itself would not work. Therefore, an emergency control means 22 may allow the provision of pressure into the pressure chamber 5 or, the provision of a negative pressure of vacuum to the pressure chamber 5 so as to cause the fluid control surface 3 to assume either the open or close position as desired in the circumstances.

Although it is considered cheaper to operate the valve line on the inlet and outlet pressures from the valve mechanism itself, the provision of such external power sources may be necessary.

In the control of control means 22, it is preferable to provide short pulses to the transmitters in the electromechanical transmitted control means 22 so as to provide a series of small movements at the valve rather than one continuous movement by merely switching the control means on or off once. This will provide more accurate control of the valve than trying to obtain a full movement of the valve from one position to a further position through a single opening and closing of a suitable conduit 31 or 32.

A yet further embodiment of the invention as shown in Figures 9 and 10. In this embodiment, a modulating valve 40 is provided, again with control means 22 over both the inlet 41 and outlet 42 from the pressure chamber 43.

In this particular embodiment, the main valve mechanism may be provided by a ring like piston 44 acting between the side wall of the conduit 45 and a central sealing portion 46. Such an arrangement may be provided in both a modulating valve 40 as shown with two control means 22 over both the inlet orifice 41 and outlet orifice 42 from the pressure chamber 43 or in the previous embodiments in which only a single control is provided.

It can be seen that the central sealing portion 46 may be supported by a bridging portion 47 extending from the central portion 46 adjacent, in this preferred embodiment, opposed sides of the sealing portion 46 and supported from a connected inner portion to the conduit 48. This arrangement provides convenient means for providing the central seal 46 substantially axial within the conduit such that the ring like piston 44 may act circumferentially about the central portion 46 to seal adjacent the side walls of the conduit 45.

As with previous embodiments, a biasing means such as a spring 49 is provided to bias the control surface 44 against the seal 46.

The inlet pressure from the inlet side of the control surface 44 may travel through suitable passageways 50 into an upper chamber 51. For this pressure to be allowed to pass through a further passageway 53 into the pressure chamber 43, it must travel through the inlet orifice 41 controlled by the control means 22.

Similarly, pressure from the pressure chamber 43 may be released through the passage of fluid through passageway 54 to the outlet orifice 42 and thereby to the outlet from the valve 40.

As with the previous embodiment provided with dual control means 22, the entry of fluid and pressure into the pressure chamber 43 may be strictly controlled as can the release of pressure to the outlet of the valve such that, with both control means 2 closing the respective orifices 41 and 42, the valve control surface 44 will be maintained in the position it has assumed at that time. The opening and closing of the orifices to only allow a small amount of fluid to pass through each orifice as desired allows the control surface 44 to be

positioned and maintained at a specific preferred position between the fully opened and fully closed positions. The opening of the outlet orifice 42 will slowly release pressure to allow the control surface 44 to move rearward from its seal adjacent sealing means 46 and slowly open the valve. By contrast, the opening of the inlet orifice 41 will allow an increased pressure in the pressure chamber 43 to increment the control surface 44 towards its closed position against the seal 46.

It is preferred that the control means 22 in these instances is provided by an electronic or electrically controlled coil to accommodate electronic control of the valve 40. In addition, a manual override 55 may be provided on each control means 22 for manual actuation.

A yet further embodiment of the invention as shown in Figures 11 and 12. As with the previous embodiment, the pressure chamber 43 is placed behind a control surface 44 acting between the side walls 45 and a central sealing portion 46. Similarly, the inlet orifice 41 and outlet orifice 42 are each provided with control means such as the control means 22 on the outlet 42. However, this particular embodiment provides an adjustable control means 56 over the inlet orifice 41.

As has been described previously, control of the outlet orifice 42 to release fluid from the pressure

chamber 43 may control the opening of the control surface 44. When this outlet 42 is open, the control surface 44 will travel towards the outlet of the valve and away from its seal against the sealing portion 46. In this instance, rather than a control over the opened and closed nature of the inlet orifice 41, the control means 56 provides an adjustable control over the size of the opening of the inlet orifice 41. If this inlet orifice is small in comparison with the outlet orifice 42, although the valve will assume a fully closed position with the outlet orifice 42 closed by the control means 22, when the outlet 42 is open, the outlet 42 has no difficulty in releasing a substantial volume of the pressure within the pressure chamber 43 despite the continuous incoming pressure through the inlet orifice 41. Therefore, the control surface 44 may assume a fully open position.

If the size of the inlet orifice 41 is increased through manipulation of, for example, a threaded control means 56 adjusting the size of the inlet orifice, the increased flow rate of fluid through the inlet orifice 41 will increase the pressure in the pressure chamber 43 even with the outlet orifice 42 in a fully open position.

The provision of such an adjustment 56 allows the fully open position of the control means 44 within the

valve means 40 to be determined and adjusted to a suitable value. This allows the valve to provide a specific flow rate in its fully open position.

Another feature which should be noted in all the embodiments is the possibility for the surface area of the control surface 44 being acted upon by the pressure within the pressure chamber 43 may be larger than the surface area exposed to the inlet flow into the valve. Such a differential and surface area allows for extra bias to be applied to the control surface 44 which may negate the need for the specific biasing means provided by the spring or other such biasing means 49 or at least reduce the quantity of bias necessary to be supplied by the biasing means 49.

A yet further embodiment of the invention is shown in cross section in Figure 13. In this embodiment, the fluid control mechanism comprises a valve in which the control surface 44 is again provided as a ring like piston acting between a central sealing portion 46 and the side walls 45 of the conduit. In this particular embodiment a set inlet orifice 61 is provided with no control over the opening and closing of this inlet and the outlet orifice 62 is controlled by the control means 22 being a coil powered core 63 seated on the outlet 62.

However, in this embodiment, a further control surface 64 is provided upstream of the valve to seal against a sealing portion 66 to close the conduit. This control surface 64 may be biased into the closed position by a biasing means such as a spring or other bias 65.

In providing such a surface, only a specific inlet pressure will overcome the bias and the control surface 64 will act as a pressure reduction mechanism to reduce the pressure upstream of the valve immediately prior to its approaching the control surface 44. The provision of this pressure reduction portion co-axially and directly adjacent the valve portion 40 provides convenient pressure reducing valve which is compact in nature.

Other embodiments of this device including a fluid control surface which controls the fluid through shifting from a first to a second position, can be provided which still uses the elements of a pressure chamber provided on one side of the control surface and a variation in that pressure to accommodate the shifting of the control surface. This system may be used for pumps, hydraulic motors and other hydraulic and pneumatic devices. Furthermore, even within the range of valves, many variations are possible, such as the

provision of more than one valve plug and associated pressure chamber within a single conduit.

It should also be noted that the valve mechanism as shown can be fitted to other conduits through any convenient means.

Thus it can be seen that a fluid control apparatus and method for controlling fluids is provided with advantages over the prior art.

Where in the foregoing description reference has been made to specific components or integers of the invention having known equivalents then such equivalents are herein incorporated as if individually set forth.

Although this invention has been described by way of example and with reference to possible embodiments thereof it is to be understood that modifications or improvements may be made thereto without departing from the scope or spirit of the invention.

CLAIMS

1. In a first aspect, the invention consists in a fluid control mechanism comprising:-

a conduit to carry a fluid having an axis therethrough;

a fluid control surface within said fluid flow and having a high pressure side and a low pressure side;

a pressure chamber associated with one side of said fluid control surface;

a control means to control the pressure in said pressure chamber and thereby shift the control surface from a first position to a second position; and

wherein said fluid control surface is positioned within said conduit and acts along said axis of said conduit when shifting from said first to said second position.

2. A fluid control mechanism as claimed in claim 1 wherein said fluid control surface comprises a valve with said first position being a closed position of said valve and a second position being an open position of said valve.

3. A fluid control mechanism as claimed in claim 1 or claim 2 wherein said pressure chamber is provided on the low pressure side of said fluid control surface.

4. A fluid control mechanism as claimed in any one of the preceding claims wherein said control means is provided on an opening from said pressure chamber to a source of lower or higher pressure.

5. A fluid control mechanism as claimed in claim 4 wherein control means are provided on both an opening to a high pressure source and an opening to a low pressure source.

6. A fluid control mechanism as claimed in claim 5 wherein said high and low pressure sources are the pressures on the high and low sides of said fluid control surface.

7. A fluid control mechanism as claimed in claim 6 wherein said control means provided on said opening from said high pressure side of said fluid control surface comprises an adjusting means to adjust the size of said opening from said high pressure side of said control surface to said pressure chamber and said control means on said opening from said

pressure chamber to said low pressure side of said fluid control surface comprises a means to open and close said opening from said pressure chamber to said low pressure side of said fluid control surface.

8. A fluid control mechanism as claimed in any one of the preceding claims wherein said mechanism further includes a pressure reduction mechanism to reduce the incoming pressure towards said fluid control surface.

9. A fluid control mechanism as claimed in any one of the preceding claims wherein said mechanism includes a biasing means provided to bias said control surface to said first position.

10. A valve mechanism comprising a conduit, a valve seat, a valve plug, a support for said valve plug, a pressure chamber provided on the low pressure side of said valve plug, a first orifice between an inlet side of said valve plug and said pressure chamber, a second orifice between said pressure chamber and an outlet side of said valve plug, control means provided on said second orifice to open or close said orifice, and biasing means to bias said valve plug to a closed position when the

pressure in said pressure chamber is at least greater than the outlet pressure and at least less than or equal to the inlet pressure and wherein said valve plug moves axially within said conduit between said open and closed positions.

11. A method of controlling fluid comprising:-

providing a fluid control surface within a fluid flow within a conduit to define a high pressure side on one side of said control surface and a low pressure side on the opposed side of said control surface;

providing a pressure chamber associated with said low pressure side of said control surface and controlling the pressure within said pressure chamber to move the fluid control surface axially within said conduit and thereby control said fluid.

12. A method of controlling fluid as claimed in claim 11 wherein said control of said pressure within said pressure chamber is provided by the provision of an inlet from said high pressure side to said pressure chamber and an outlet from said pressure chamber to said low pressure side and controlling the opening or closure of at least one of said inlet or outlet.

13. A fluid control mechanism comprising:

a conduit to carry a fluid;
a fluid control surface within said fluid flow and having a high pressure side and a low pressure side;
a pressure chamber associated with one side of said fluid control surface;
a control means to control the pressure in said pressure chamber and thereby shift the control surface from a first position to a second position; and
wherein said control means comprises a means to control the passage of fluid from a high pressure side of said fluid control surface to said pressure chamber and further means to control the passage of fluid from said pressure chamber to said low pressure side of said fluid control surface.

14. A fluid control mechanism as claimed in claim 13 wherein said means to control said openings comprise means acting across passageways between said high and low pressure sides of said fluid control surface and said pressure chamber.

15. A fluid control mechanism as claimed in claim 14 wherein said means to act across passageways comprise electronically controlled valves.

16. A fluid control mechanism substantially as hereinbefore described with reference to the accompanying drawings.

17. A method of controlling fluid substantially as hereinbefore described with reference to the accompanying drawings.

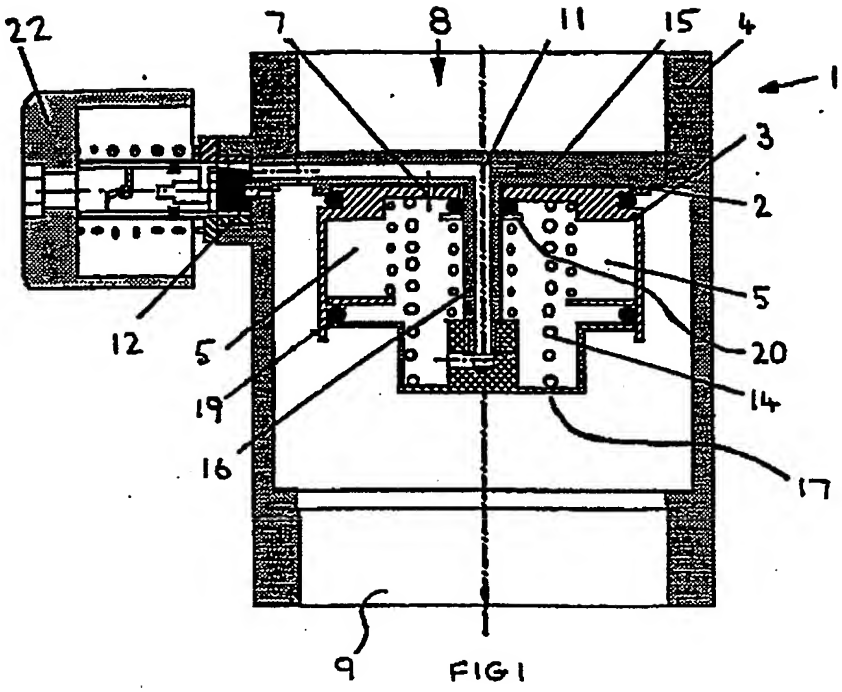

FIG 1

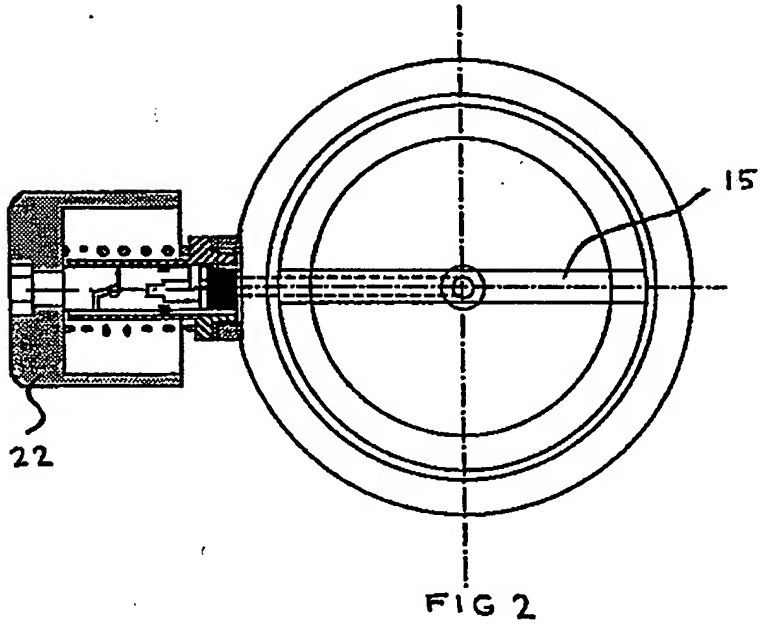

FIG 2

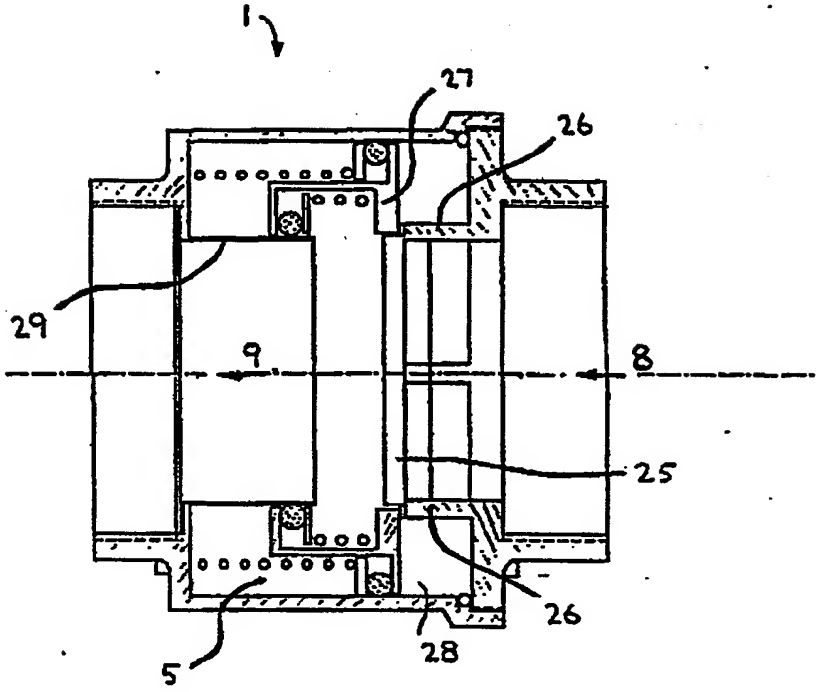

FIG 3

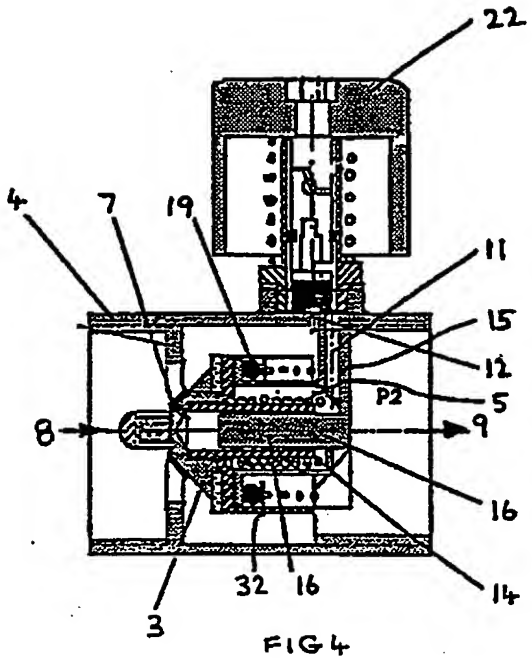

FIG4

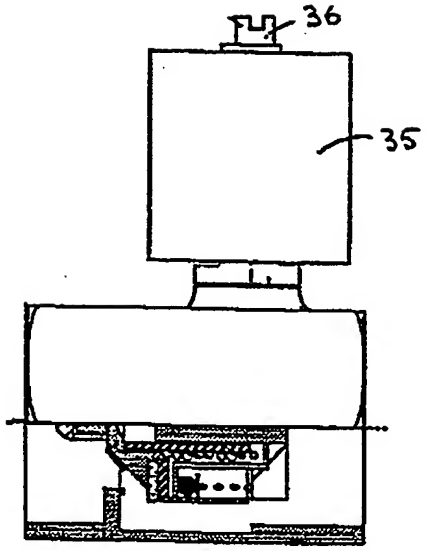

FIG5

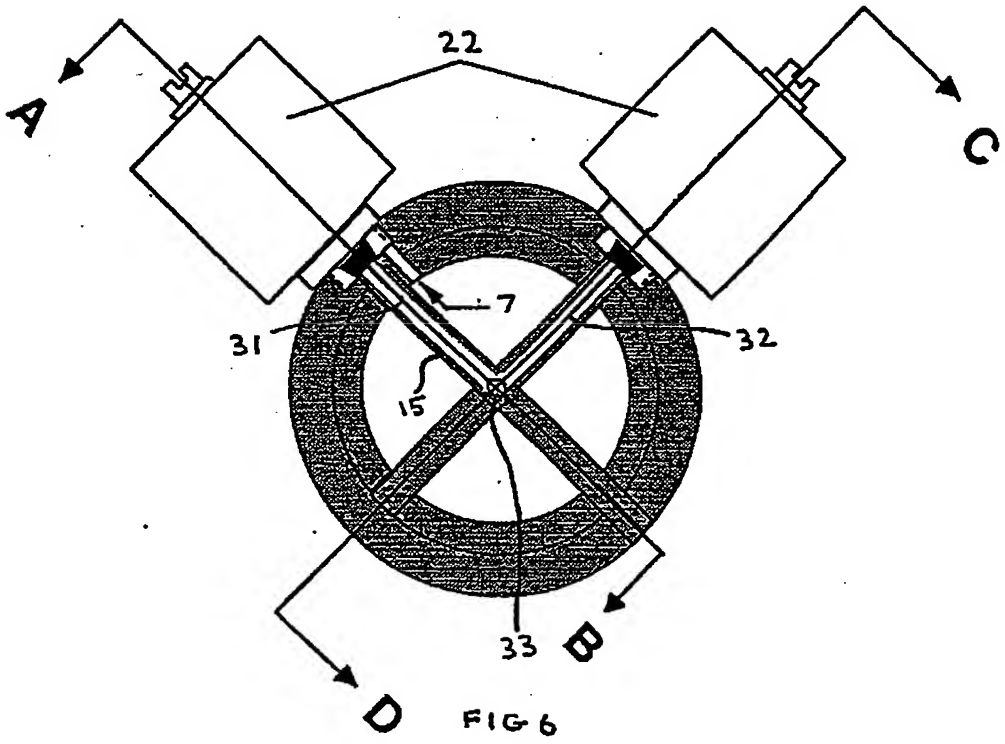

FIG 6

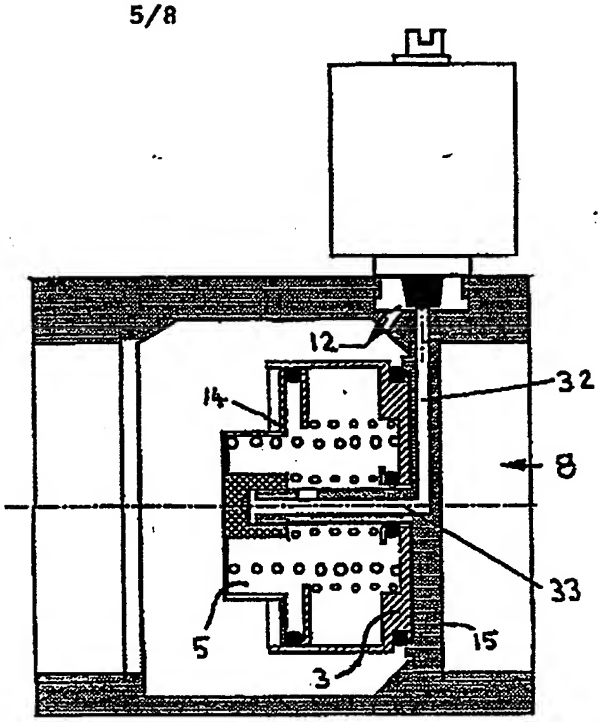

FIG7

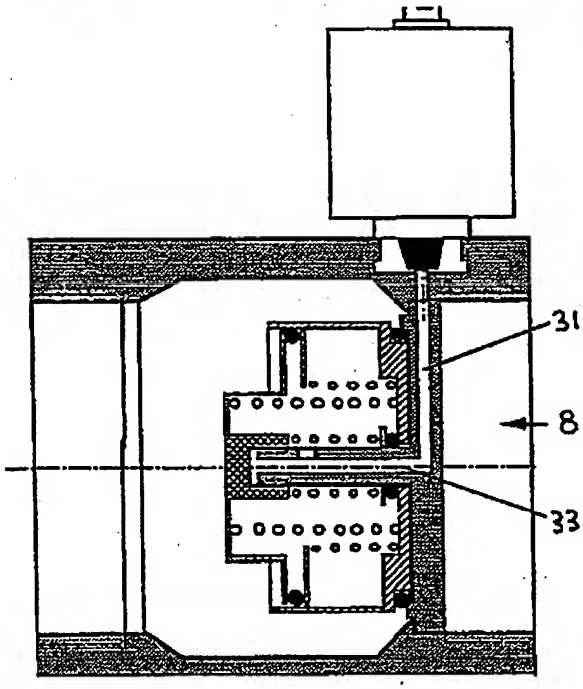

FIG8

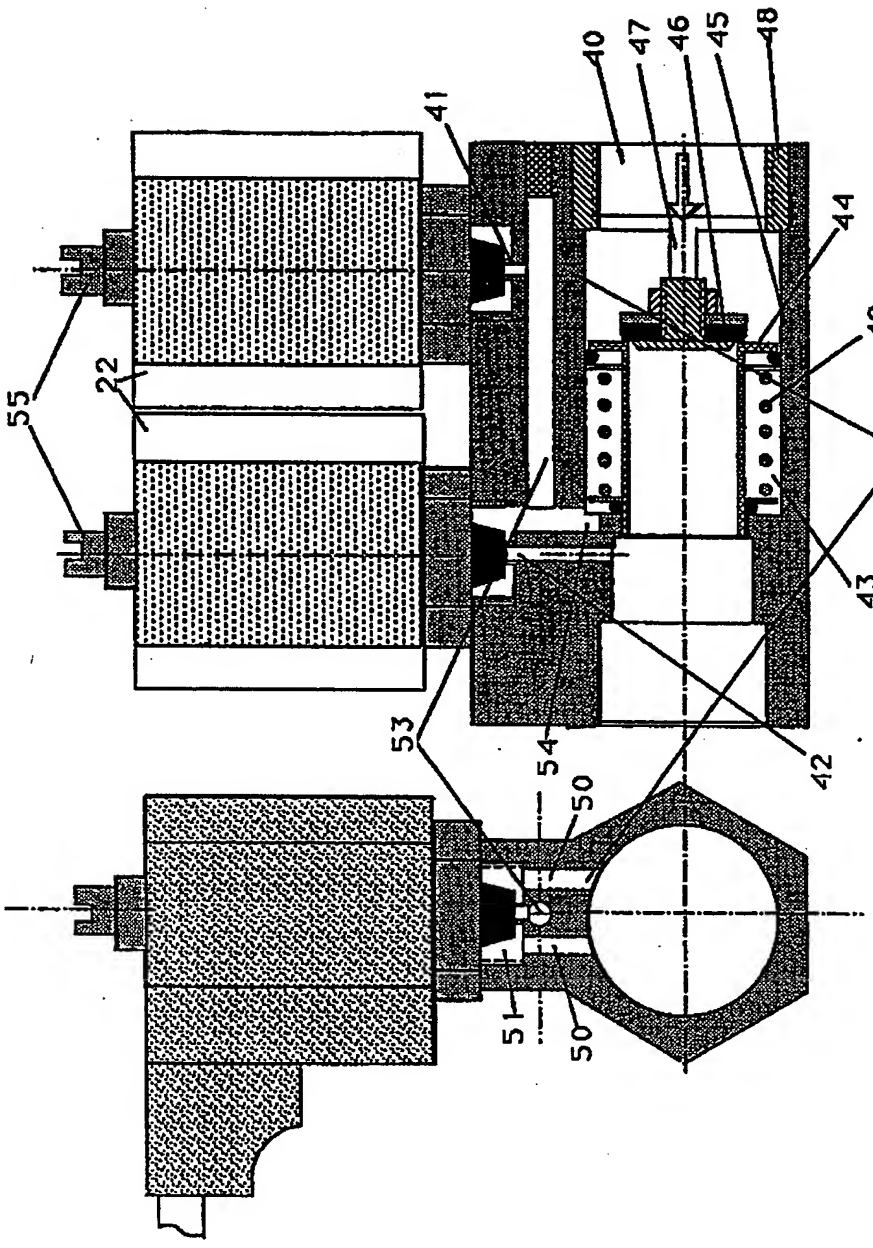

FIG 9

Fig 10

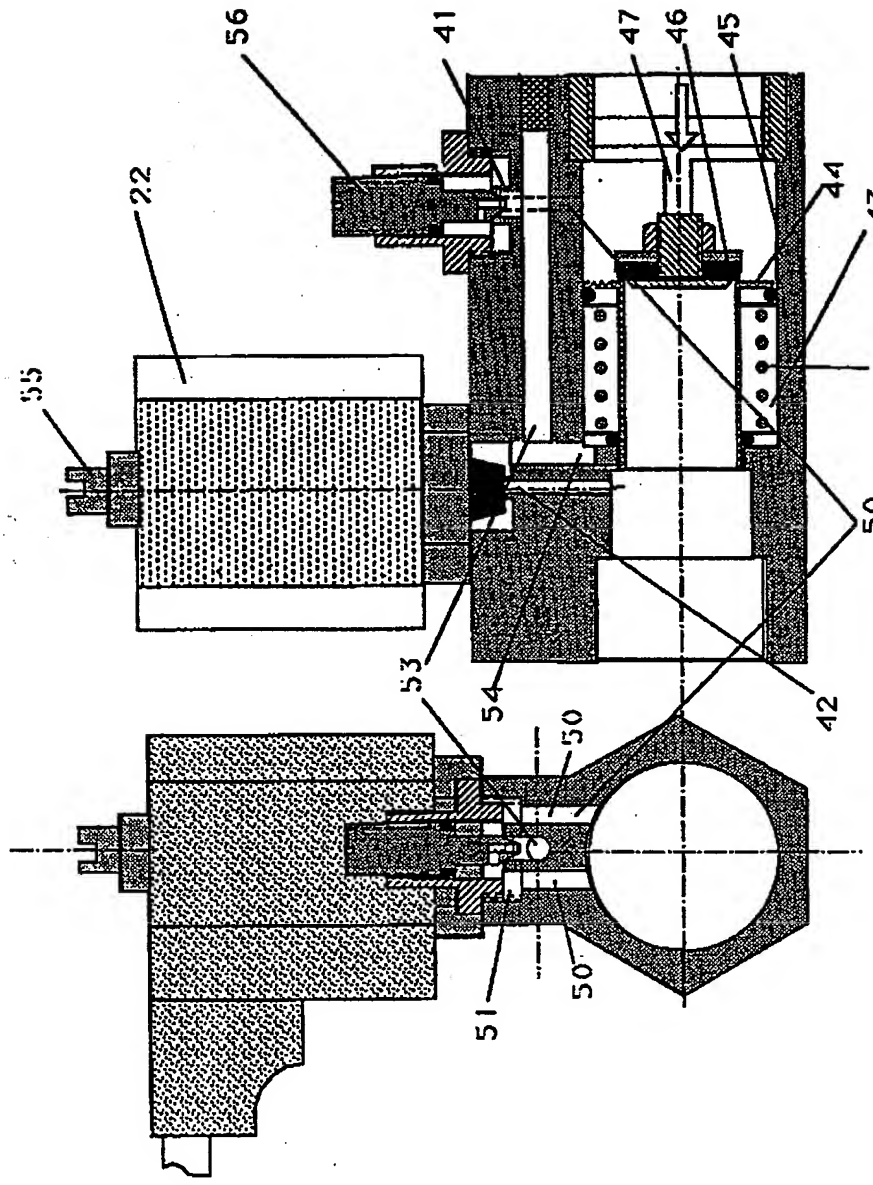

Fig 11

Fig 12

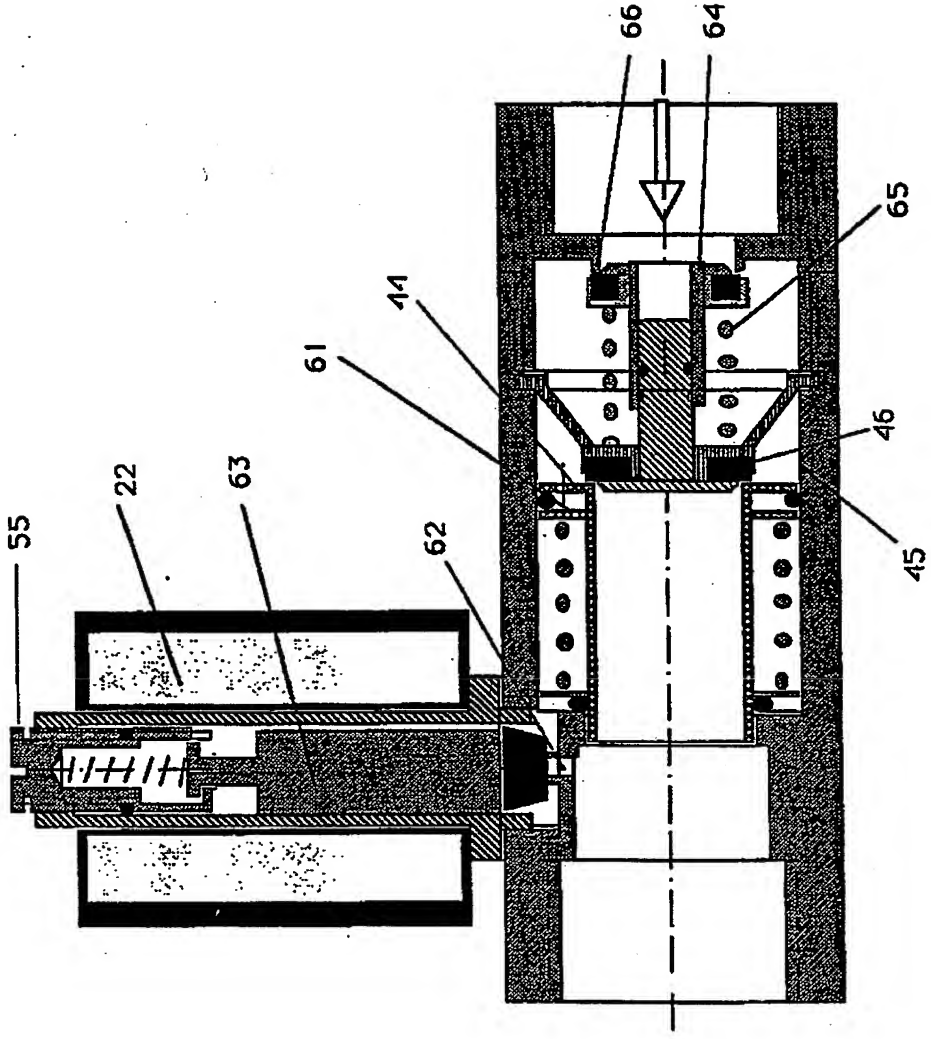

Fig 13

INTERNATIONAL SEARCH REPORT

International application No.
PCT/NZ 95/00020

A. CLASSIFICATION OF SUBJECT MATTER

Int. Cl.[6] F16K 31/40, 31/363, 1/12

According to International Patent Classification (IPC) or to both national classification and IPC

B. FIELDS SEARCHED

Minimum documentation searched (classification system followed by classification symbols)

IPC F16K 31/36, 31/363, 31/38, 31/383, 31/40

Documentation searched other than minimum documentation to the extent that such documents are included in the fields searched

AU: IPC as above

Electronic data base consulted during the international search (name of data base, and where practicable, search terms used)

C. DOCUMENTS CONSIDERED TO BE RELEVANT

Category*	Citation of document, with indication, where appropriate, of the relevant passages	Relevant to Claim No.
	DE 2422190 A (BRAUKMANN) 27 November 1975	
X	whole document	1-14
Y	whole document	1-7, 9, 10, 12-14
Y	whole document	15
	AU 72927/74 B (495039) (DAWSON)	
X	whole document	1-14
Y	whole document	6, 7, 9, 10, 12-14
	Derwent WPAT Online Abstract Accession No 76-A8970x/05, DL 100790 (NESTLER) 20 November 1975	

[X] Further documents are listed in the continuation of Box C.

[X] See patent family annex.

* Special categories of cited documents :

"A" document defining the general state of the art which is not considered to be of particular relevance

"E" earlier document but published on or after the international filing date

"L" document which may throw doubts on priority claim(s) or which is cited to establish the publication date of another citation or other special reason (as specified)

"O" document referring to an oral disclosure, use, exhibition or other means

"P" document published prior to the international filing date but later than the priority date claimed

"T" later document published after the international filing date or priority date and not in conflict with the application but cited to understand the principle or theory underlying the invention

"X" document of particular relevance; the claimed invention cannot be considered novel or cannot be considered to involve an inventive step when the document is taken alone

"Y" document of particular relevance; the claimed invention cannot be considered to involve an inventive step when the document is combined with one or more other such documents, such combination being obvious to a person skilled in the art

"&" document member of the same patent family

Date of the actual completion of the international search	Date of mailing of the international search report
9 June 1995	13 JUNE 1995 (13.06.95)
Name and mailing address of the ISA/AU	Authorized officer
AUSTRALIAN INDUSTRIAL PROPERTY ORGANISATION PO BOX 200 WODEN ACT 2606 AUSTRALIA	DEREK BUTLER
Facsimile No. 06 2853929	Telephone No. (06) 2832347

INTERNATIONAL SEARCH REPORT

International application No.
PCT/NZ 95/00020

C(Continuation). DOCUMENTS CONSIDERED TO BE RELEVANT		
Category*	Citation of document, with indication, where appropriate of the relevant passages	Relevant to Claim No.
X	whole document	1, 2, 4, 8-12
Y	whole document	9, 10, 12-14
Y	whole document	6, 7
	DE 3913990 C1 (HI-SONIC CO LTD) 13 June 1990	
X	whole document	1, 2, 4, 8, 11, 12
Y	whole document	1, 2, 4, 12
Y	whole document	3, 5-7, 9, 10, 13, 14
	US 5069248 A (GILL) 3 December 1991	
X	figures 2, column 6 line 51 to column 7 line 1	11-14
	US 3865128 A (ZADOO) 11 February 1975	
X	whole document	1-5, 9, 11
Y	whole document	6-7, 10, 12-14
Y	whole document	1-5, 9
	GB 1494734 A (NORMALAIR-GARRETT HOLDINGS LTD) 14 December 1977	
X	whole document	1-5, 8, 9, 11
Y	whole document	6, 10, 12
Y	whole document	1-5, 9
	US 5168894 A (DESMARAIS) 8 December 1992	
X	whole document	1-6, 8, 11-15
Y	whole document	7, 10
Y	whole document	12-14, 15
	EP 343288 A1 (KOPPENS AUTOMATIC FABRIEKEN B V) 29 November 1988	
X	whole document	11-15
Y	whole document	1-6, 9, 10
Y	whole document	12-15
	EP 57581 A2 (GROVE VALVE AND REGULATOR COMPANY) 11 August	
X	1982	11-15
Y	whole document	12-15
Y	whole document	1-10
	whole document	
X	EP 369969 A2 (BAHCO HYDRAUTO AB) 23 May 1990	11, 12
Y	whole document	12
Y	whole document	6, 7, 10, 13, 14
A	whole document	1-10
	whole document	
X	AU 24554/92 A (HASSAR) 25 March 1993	11, 12
X	whole document	13, 14
Y	page 2 lines 2-5	12-14
Y	whole document	6, 7, 10
A	whole document	1-10
	whole document	

INTERNATIONAL SEARCH REPORT

International application No.
PCT/NZ 95/00020

Box I Observations where certain claims were found unsearchable (Continuation of Item 1 of first sheet)

This international search report has not established in respect of certain claims under Article 17(2)(a) for the following reasons:

1. ☐ Claims Nos.:
because they relate to subject matter not required to be searched by this Authority, namely:

2. ☐ Claim Nos.:
because they relate to parts of the international application that do not comply with the prescribed requirements to such an extent that no meaningful international search can be carried out, specifically:

3. ☐ Claims Nos.:
because they are dependent claims and are not drafted in accordance with the second and third sentences of Rule 6.4(a).

Box II Observations where unity of invention is lacking (Continuation of item 2 of first sheet)

This International Searching Authority found multiple inventions in this international application, as follows:

1. ☐ As all required additional search fees were timely paid by the applicant, this international search report covers all searchable claims

2. ☐ As all searchable claims could be searched without effort justifying an additional fee, this Authority did not invite payment of any additional fee.

3. ☐ As only some of the required additional search fees were timely paid by the applicant, this international search report covers only those claims for which fees were paid, specifically

claims Nos.:

4. ☐ No required additional search fees were timely paid by the applicant. Consequently, this international search report is restricted to the invention first mentioned in the claims; it is covered by claims Nos.:

Remark on Protest

☐ The additional search fees were accompanied by the applicant's protest.

☐ No protest accompanied the payment of additional search fees.

INTERNATIONAL SEARCH REPORT
Information on patent family membe

International application No.
PCT/NZ 95/00020

This Annex lists the known "A" publication level patent family members relating to the patent documents cited in the above-mentioned international search report. The Australian Patent Office is in no way liable for these particulars which are merely given for the purpose of information.

Patent Document Cited in Search Report	Patent Family Member					
DE 2422190						
AU 72927/74						
DD 100790	BG	20625	CS	174881	HU	174944
	RO	57227				
DE 3913990						
US 5069248	US	4967793	US	5060691	AU	55375/90
	WO	9012974	AU	66155/90	CA	2080815
	EP	591146	JP	5509375	WO	9116562
US 3865128	CA	982444	DE	2342020	FR	2199086
	GB	1404254	JP	49064925		
GB 1494734	DE	2460161	FR	2255530		
US 5168894						
EP 343288	AT	77683	DE	3872385	ES	2032950
	US	5042775				
EP 57581	JP	57177478				
EP 369969	AU	44629/89	DK	5690/89	FI	93053
	JP	2180391	JP	4056196	SE	8804116
	US	4964611				
AU 24554/92						

END OF ANNEX